

Amendments to the claims

This listing of claims replaces all prior versions, and listings, of claims in the application.

Listing of claims:

1. (Currently amended) An apparatus for variable focusing ~~focusing, deflection and aberration correction~~ of charged particles ~~ion optical components~~ used for implanting a plurality of charged particles into semiconductor materials thereby modifying properties of said semiconductor materials said apparatus comprising:

a structure manufactured from a magnetic material said structure having a long dimension and a short dimension;

an upper magnetic core member having said long dimension between its ends;

a lower magnetic core member having said long dimension between its ends said lower core member being oriented with its axis substantially parallel to the axis of said upper core and its ends substantially aligned with the ends of said upper core member;

a plurality of ~~independent current excited~~ coil units distributed along both said upper and lower core members each said coil unit comprising a single continuous electrical circuit that surrounds an individual core member; ~~and~~

additional magnetic members connected between ends of said upper and lower magnetic core members to form the short dimensions

~~dimension~~ of a rectangular ~~frame~~ frame;

a plurality of coil units distributed along both additional magnetic members forming the short dimensions of said rectangular frame; and

means for independently exciting said upper and lower coil units by currents which are in one direction for the coil units distributed along said upper magnetic core member and in the opposite direction for the coil units distributed along said lower magnetic core member when viewed from one end of said rectangular frame; and

means for independently exciting said coil units distributed along one or both additional magnetic members.

2. (Original) The apparatus of claim 1 wherein said members of the plurality of independently current excited coil units are equally spaced.

3. (Currently amended) The apparatus of claim 1 wherein the said independently excited plurality of coil members have an identical number of coil turns ~~coils~~.

4. (Original) The apparatus of claim 1 wherein said short dimension members of said structure comprise a non-magnetic material.

5. (Cancelled)

6. (Original) The apparatus of claim 1 wherein a single current excited winding encircles one or both of said short dimension core members.

7. (Original) The apparatus of claim 1 wherein individual ones of

said current excited coil units are super conducting.

8. (Currently amended) The apparatus of claim 1 further comprising a current controller for independently changing the current passing through said individual coil units ~~and producing~~ to produce a controllable magnetic field configuration between said upper and lower magnetic core ~~members.~~ members, said configuration including the fundamental quadrupole needed together with dipole and higher order corrections to the quadrupole field to introduce aberration correction and small deflection.

9. (Original) An apparatus for focusing, deflection and aberration-correction of ion optical components used for implanting a plurality of charged particles into semiconductor materials thereby modifying properties of said semiconductor materials said apparatus comprising:

an upper basic magnetic core member having a long dimension between its ends;

a lower basic magnetic core member having said long dimension between its ends said lower core member being oriented with its axis substantially parallel to the axis of said upper basic core and with its ends substantially aligned with the ends of said upper core member;

a plurality of independent current excited coil units distributed along both said upper and lower basic magnetic core members, each said coil unit comprising a single continuous electrical circuit that surrounds an individual basic magnetic

core member;

magnetic core extension units that are attached in linear array to each end of both upper and lower basic core members; and

a plurality of independent current excited coil units distributed along said magnetic core extension units, each said extension coil unit comprising a single continuous electrical circuit that surrounds an individual core extension unit.

10. (Original) The apparatus of claim 9 where each said magnetic core extension unit has a length equal to one half that of said long dimension.

11. (Original) The apparatus of claim 9 where the plurality of independent current excited coil units distributed along individual core extension units are equally spaced.

12. (Original) The apparatus of claim 9 where said coil units distributed along each said basic core extension units are connected in series.

13. (Original) The apparatus of claim 9 where said coil units distributed along a core extension unit are wound serially in the form of a single winding.

14. (Currently amended) The apparatus of claim 9 wherein for each of said upper and lower basic core units the sum of the ampere-turns generated by the coils surrounding said basic magnetic core member is equal and opposite to the sum of the ampere turns generated by the extension coil units distributed along said basic magnetic core ~~members.~~ extension units.

15. (New) An apparatus for variable focusing, deflection and

aberration-correction of ion optical components used for implanting a plurality of charged particles into semiconductor materials thereby modifying properties of said semiconductor materials said apparatus comprising:

a structure manufactured from a magnetic material said structure having a long dimension and a short dimension;

an upper magnetic core member having said long dimension between its ends;

a lower magnetic core member having said long dimension between its ends said lower core member being oriented with its axis substantially parallel to the axis of said upper core and its ends substantially aligned with the ends of said upper core member;

additional magnetic members connected between ends of said upper and lower magnetic core members to form the short dimension of a rectangular frame; and

a plurality of independent current excited coil units distributed along all four of said core members each said coil unit comprising a single continuous electrical circuit that surrounds an individual core member.